User manual

ADA-4040A
Addressable RS485 / RS422 Baud Rate Converter

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1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.
If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail support@cel-mar.pl.

1.1. WARRANTED INFORMATION

ADA-4040A converter is covered by a two year warranty from date of sale. In case of being damaged it will be repair or the damaged component will be replace. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions, will be repaired or replaced.
All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company.**
CEL-MAR Company under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.
CEL-MAR Company is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.
In specific cases **CEL-MAR Company** discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.
Do not put device on the wet surface.
Do not connect devices for nondescript powering sources,
Do not damage or crush powering wires.
Do not make connection with wet hands.
Do not adapt, open or make holes in casings of the device!
Do not immerse device in water or no other liquid.
Do not put the fire opened on device sources: candles, an oil lamps and the like.
Complete disable from the supply network is only after disconnecting the power supply circuit voltage.
Do not carry out the assembly or disassembly of the device if it is enabled. This may result to short circuit and damage the device.

1.3. CE LABEL

CE symbol on organizing the company CEL-MAR a conformity of the device to the directive of the electromagnetic EMC 89/336/EWG compatibility means (Electromagnetic Compatibility Directive). The declaration of the agreement is accessible through the contact with the technical service at the address e-mail: support@cel-mar.pl or on the phone at the +48 41 362-12-46.

1.4. ENVIRONMENTAL PRESERVATION

This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

1.5. SERVICE AND MAINTENANCE

Konwerter ADA-4040A does not require the servicing and maintenance.
Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail support@cel-mar.pl.

2. PRODUCT INFORMATION

Converter is delivered with: User Manual, Line terminators 120W, CD-ROM with ADAConfig software.

2.1. PROPERTIES

- Possibility of adding a address to no-addressable device with RS485/422 interface,
- Baud rate and format data frame conversion between RS1 and RS2 ports,
- Possibility of connection RS-422 interface device to RS-485 network without any interference,
- Operating on 2-wire or 4-wire network in RS485/RS422 standard,
- Baud rate (bps) : 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
- Data format RS485/422 :
  - Data bit: 5, 6, 7, 8,
  - Parity: None, Odd, Even,
  - Number of stop bits: 1, 2,
- Transparent for all protocols whose the data format is compatible with the above specifications of RS485/422 interface eg. MODBUS, DNP, PROFIBUS and other,
- Power supply 10 - 30 VDC stable min. 2W,
- ~3kV= optoizolation in signal channel between RS485/RS422 (RS1) and RS485/RS422 (RS2) interface,
- 1kV= or 3kV= galvanic isolation between RS485/RS422 (RS1, RS2) interfaces and power supply (depend on version),
- Connection RS485/RS422 network and power supply via screw terminal block,
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 network,
- Implemented protection against power supply reverse connection,
- Cover compatible with DIN 43880 standard– mounting in typical electro-installation unit,
- Cover adapt to rail mounting according to DIN35 / TS35 standard,
- Cover dimensions (W x D x H) 53mm x 58mm x 90mm,

2.2. DESCRIPTION

ADA-4040A addressable baud rate converter is device solving the problem of connecting no addressable devices equipped with the RS-422 or RS-485 interface to multipoint RS485 bus by adding the address to device connected to RS2 port of converter. Converter enables to connect RS-422 devices to R-S485 bus without any interference. You can be adjust baud rate, number of bits, parity control or non parity or stop bits depending on the configuration – for RS1 and RS2 ports configuration can be different. ADA-4040A additionally separate devices from RS-485 network and can be used as repeater of RS422/RS485 bus with speed conversion between next segments about the length up to 1200m. The Converter's galvanic separation protect system constructed on RS-485/RS-422 network and increase functioning reliability.
ADA-4040A supports the asynchronous baud rate up to 230.4 kbps through four or two pairs of twisted-pair cables connected to screw terminals. The Converter use RX+, RX-, TX+/A, TX-/B lines for functioning. It is possible to connect 32 devises to RS485/RS422 network constructed on base of ADA-4040A, working at the half duplex or full duplex mode. Over-voltage protection on each RS485/RS422 line was made on base of 600W over-voltage led and fuses.

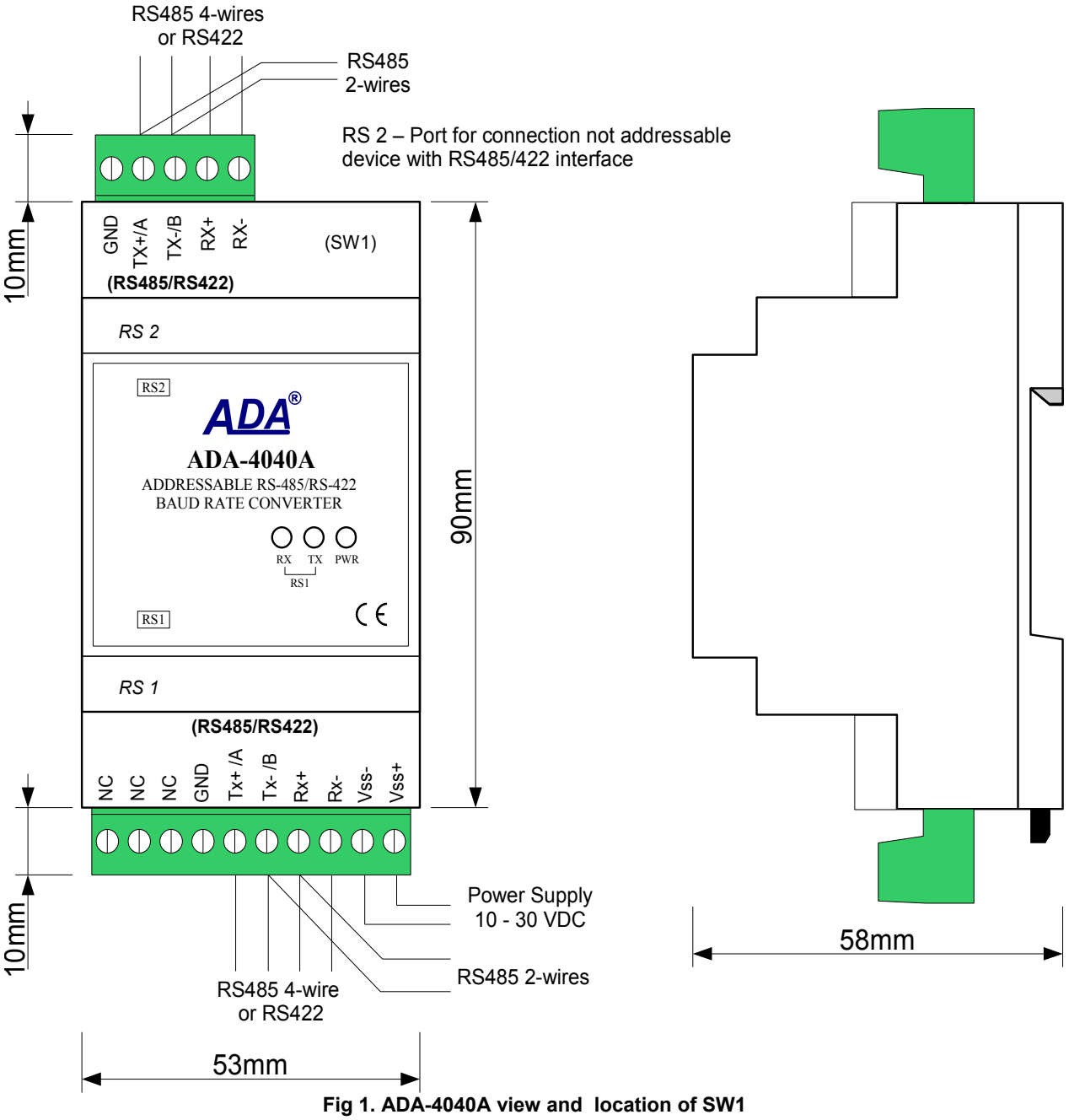

Fig 1. ADA-4040A view and location of SW1

2.3. ISOLATION

Converter ADA-4040A has 2-way or 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.

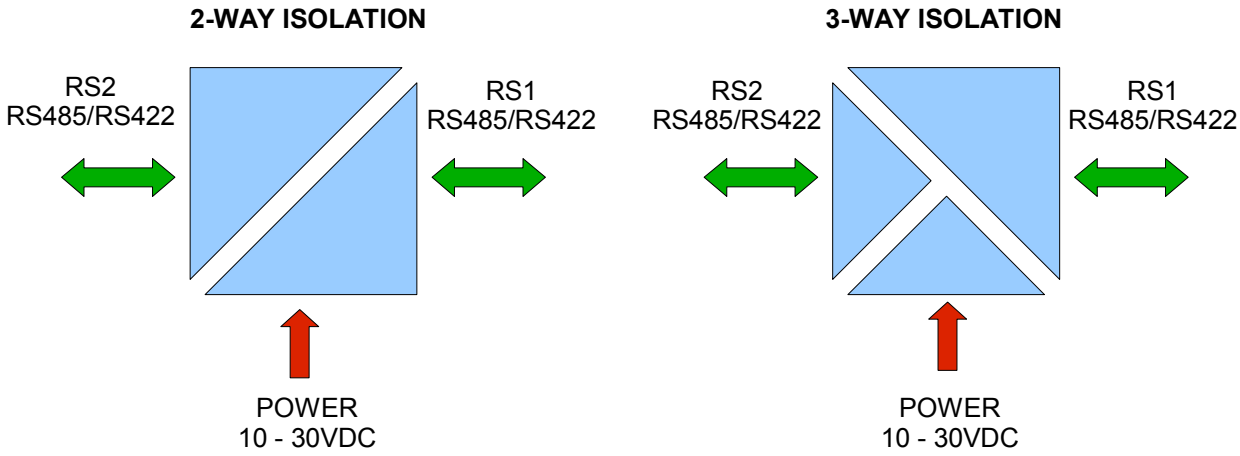

Fig 2. Isolation structure

3. INSTALLATION

This chapter will show you how to use and connect ADA-4040A to RS485, RS422 network and power supply.
In the purpose of minimization of disruptions from environment is being recommended to:
- apply multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- arrange signal cables in the distance not shorter than 25 cm from powering cables.
- apply cable of adequate cross-section due to voltage drops for converter powering,
- use suppression filters for powering converters that are installed within a single object.
- not supply converter from power circuit device that generates large impulse interference such as transmitters, contactors.

3.1. ASSEMBLING

The cover of ADA-4040A converter is adapted to assembly on TS-35 (DIN35) rail. To install converter you should mount device on the rail upper part of the cover then press bottom part to hear characteristic „Click" sound.

3.2. COMPUTER CONNECTION

To connect ADA-4040A converter via the RS1 port to computer equipped with RS-232 or USB interface you need additional converter e.g. ADA-I1040 RS232 to RS485/RS422 converter or ADA-I9140 USB to RS485/RS422 converter.
Typical connections of ADA-4040A to PC are shown bellow.
Transmission parameters of PC <=> ADA-4040A used during configuration:

- baud rate 9600 bps,
- 8 data bits,
- non parity bit,
- 1 stop bit.

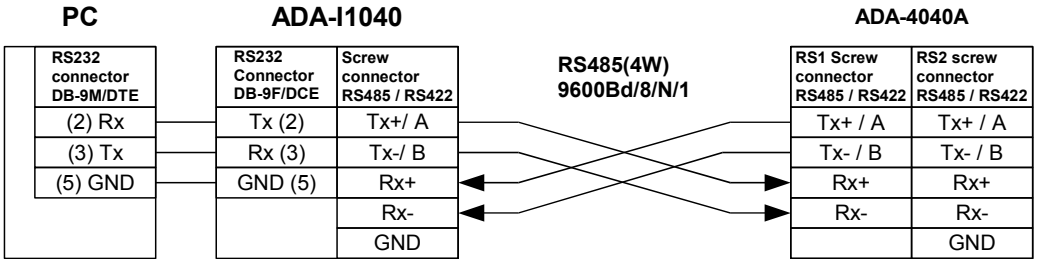

Fig 3. 4-Wires connection of ADA-4040A to PC with the use of ADA-I1040 - RS232 to RS485/RS422 converter

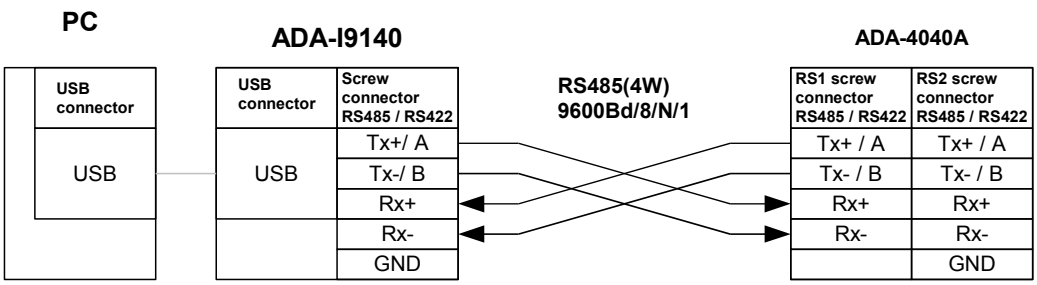

Fig 4a. 4-Wire connecting ADA-4040A to PC with the use of ADA-I9140 USB to RS485/RS422

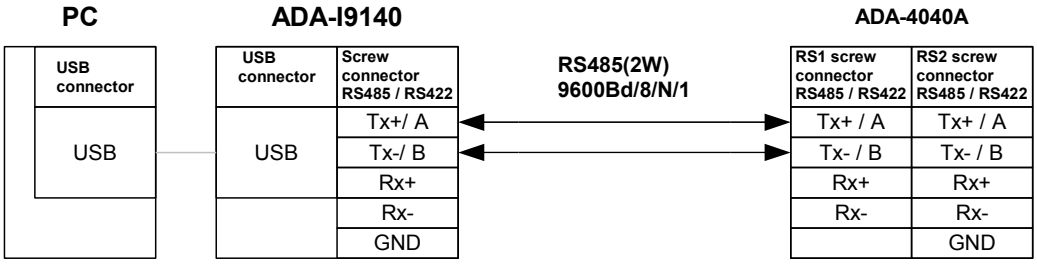

Fig 4b. 2-Wire connecting ADA-4040A to PC with the use of ADA-I9140 USB to RS485/RS422

3.3. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-4040A converter is describe as: Tx+/A, Tx-/B, Rx+, Rx-. You should connect ADA-4040A to RS485(4W) and RS485(2W) network as bellow.

3.3.1. RS485(4W) BUS CONNECTION

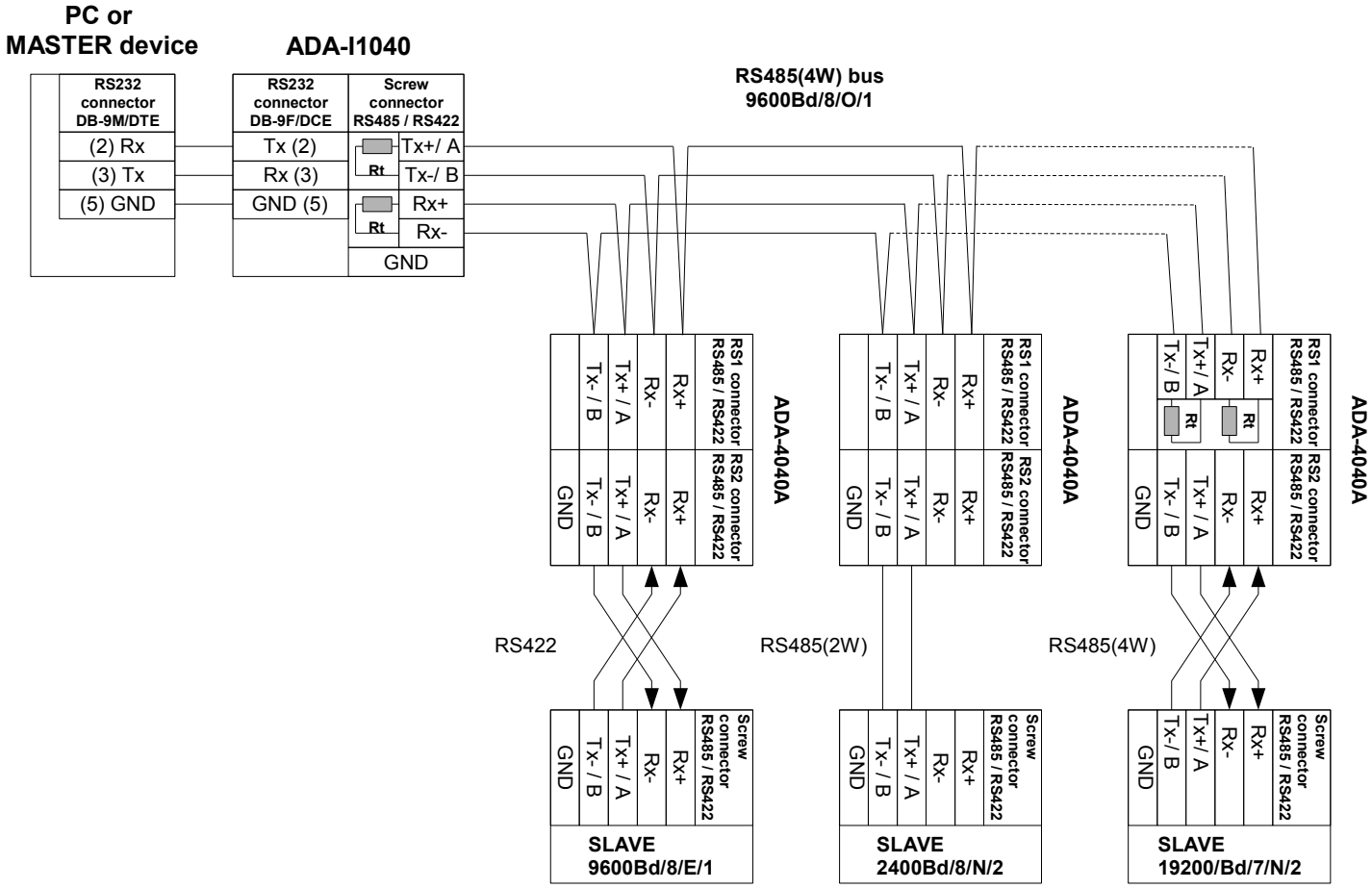

Fig 5. Example connection of ADA-4040A to RS485(4W) 4-wire bus and galvanic separation SLAVE device

3.3.2. RS485(2W) BUS CONNECTION

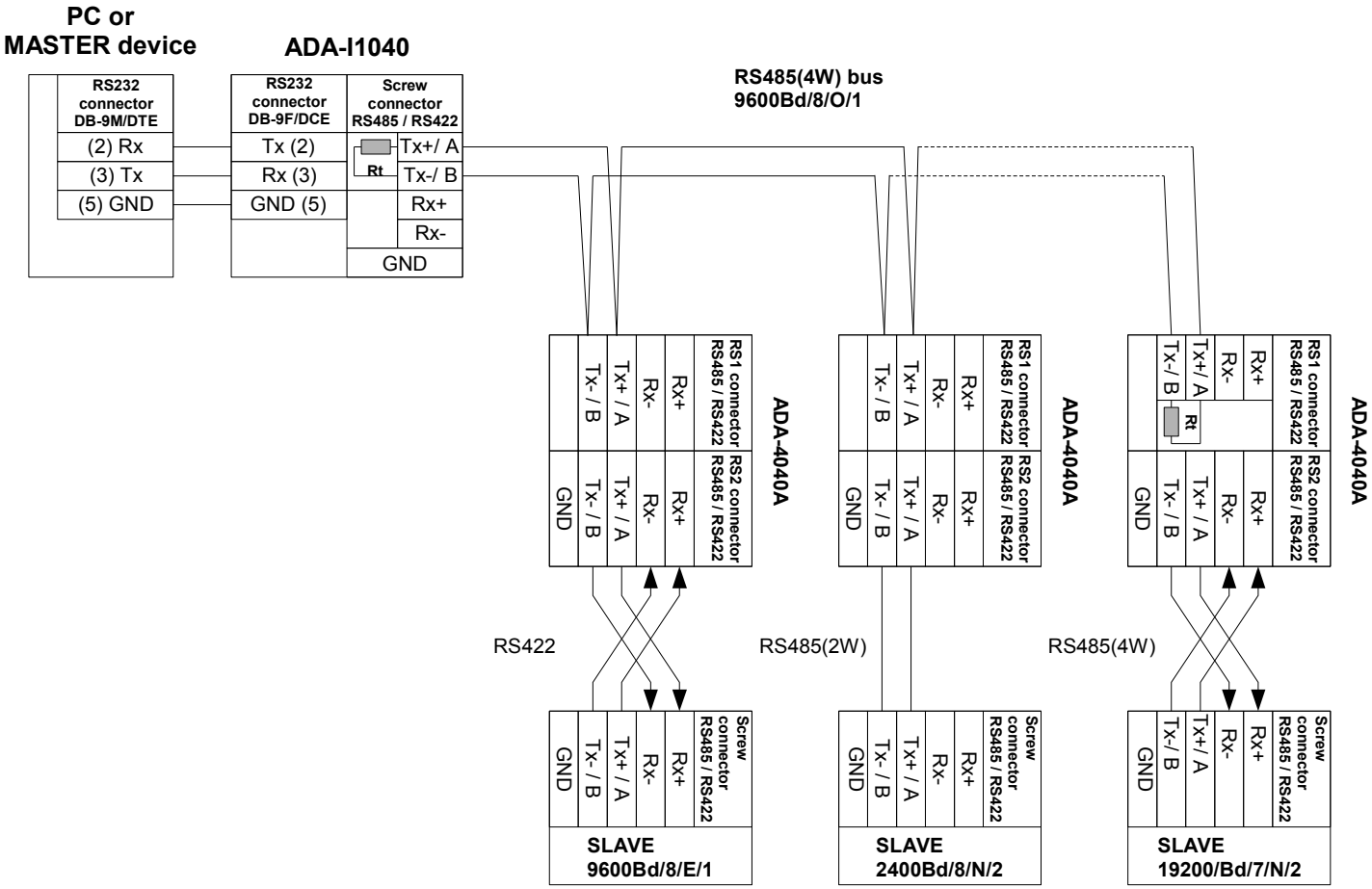

Fig 6. Example connection of ADA-4040A to RS485(2W) 2-wire bus and galvanic separation SLAVE device

3.3.3. LINE TERMINATION

The application of Line Termination (terminator) Rt = 120 ohms will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. You should use the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission. Example connection of Rt are shown on Fig. 5 & 6. Four Rt=120 W, 5%, 0,25W are delivered with the converters.

3.3.4. SLAVE DEVICE CONNECTION

Connection of SLAVE device to ADA-4040A is shown on fig.5 and fig.6.

3.4. CONNECTION OF POWER SUPPLY

To connect power supply to converter you should have DC power supplies (regulated) output voltage from 10 V= to 30V=, min. nominal power 2W, e.g. ZS-12/250 or DR-15-24. Power cable from DC power supplies to device can not be longer than 3m. You should connect positive (+) end of DC power supplies to Vss+ device terminal and negative (-) end to Vss- on terminal block. ADA-4040A has protection against power supply reverse connection. If power is properly connected, on the front panel will light green LED PRW.

4. ACIVATION

You can power on the device after properly connection according to section above.
If after connection power supply on front panel will not lighting green led PWR, you should check correctness of power supply connecting (polarization). When data is present the LEDs Tx and Rx should blink

4.1. DESCRIPTION OF SIGNALLING LEDS

LED	*Description*
PWR	Signalling of Power Supply
Run	
RX	Signalling of data receiving through ADA-4040A converter from RS1 RS485/RS422 port
TX	Signalling of data transmitting from ADA-4040A converter through RS1 RS485/RS422 port
Configuration	
LED by SW1	Blink with frequency1 Hz - signalling of configuration mode (see micro-switch SW1 setting).
Firmware updating	
LED by SW1	Blinking signalling data flow of software to converter.

ATTENTION!
AT BAUD RATE ABOVE 38.4 KBPS THE LED'S TX, RX WILL LIGHT WEAKLY DURING DATA TRANSMISSION

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not lights	Check polarization and parameters of connected power supply
Rx LED lights continuously	RS485(4W) /422 bus. Wrong polarization on terminals: Rx+, Rx-; change polarization
	RS485(2W) bus. Wrong polarization on terminals Tx+/A, Tx-/B; change polarization
No transmission Tx LED is blinking	RS485(4W) /422 bus. Check correctness of connection to terminals Tx, Rx; according to point 3

5. CONFIGURATION

5.1. OPERATION MODE

The ADA-4040A converter can operates in a few modes :
- run,
- configuration,
- emergency firmware update,
- factory default

Those modes can be set by use SW1 located by terminal block RS2 after removing terminal cover marked as SW1.
Figure 1 present the location of two-position SW1 micro-switch inside ADA-4040A.
All available adjusting the SW1 switch are shown in table below.

Converter operation modes

SW1- 1	***SW1- 2***	***Mode***
OFF	OFF	Run
ON	OFF	Configuration
ON	ON	Emergency Firmware Update
ON	OFF	Factory default Turning OFF and ON a power of the converter, a configuration will be set to factory default.

5.2. CONFIGURATION BY USING ADACONFIG

You can make the configuration of ADA-4040A converter by using *ADAConfig* Software - selling with converter.
You have to connect converter to computer and power supply to make the configuration. If the PWR LED lights you should set the section of SW1 switch to configuration mode as in table below. If not check polarization of connected power supply.

SW1-1	SW1-2
ON	OFF

If you set configuration mode the yellow LED located by SW1 micro-switch will blink with frequency 1 Hz. Now you can start ADAConfig Software and make the configuration of transmission parameters for **each converter interfaces** and set his visible address from RS1 (RS485 bus). First you should set the number of COM port for communication with the converter, then readout the configuration from ADA-4040A memory using the button ***[Read converter configuration]*** and make the proper changes of interface setting. If you set option addressing converter, on configuration window you should set proper converter address from range 1 - 255. If you set OFF this option the converter will function **as baud rate converter.**
In both cases you can set additional transmission parameters for RS1 (RS485/RS422) and RS2 (RS485/RS422) as below:
– baud rate (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
– number of data bites: 5, 6, 7, 8,
– control parity: no control, parity control, control of none parity,
– number of stop bits : 1, 2,
– frame spacing – range from 1 to 255 (time silence as frame's end),
When you finish configuration setting you should save changes on converter memory by using button ***[Write converter configuration].***
Return to work in run mode is made by using SW1 switch (yellow LED blink OFF) as below.

SW1-1	SW1-2
OFF	OFF

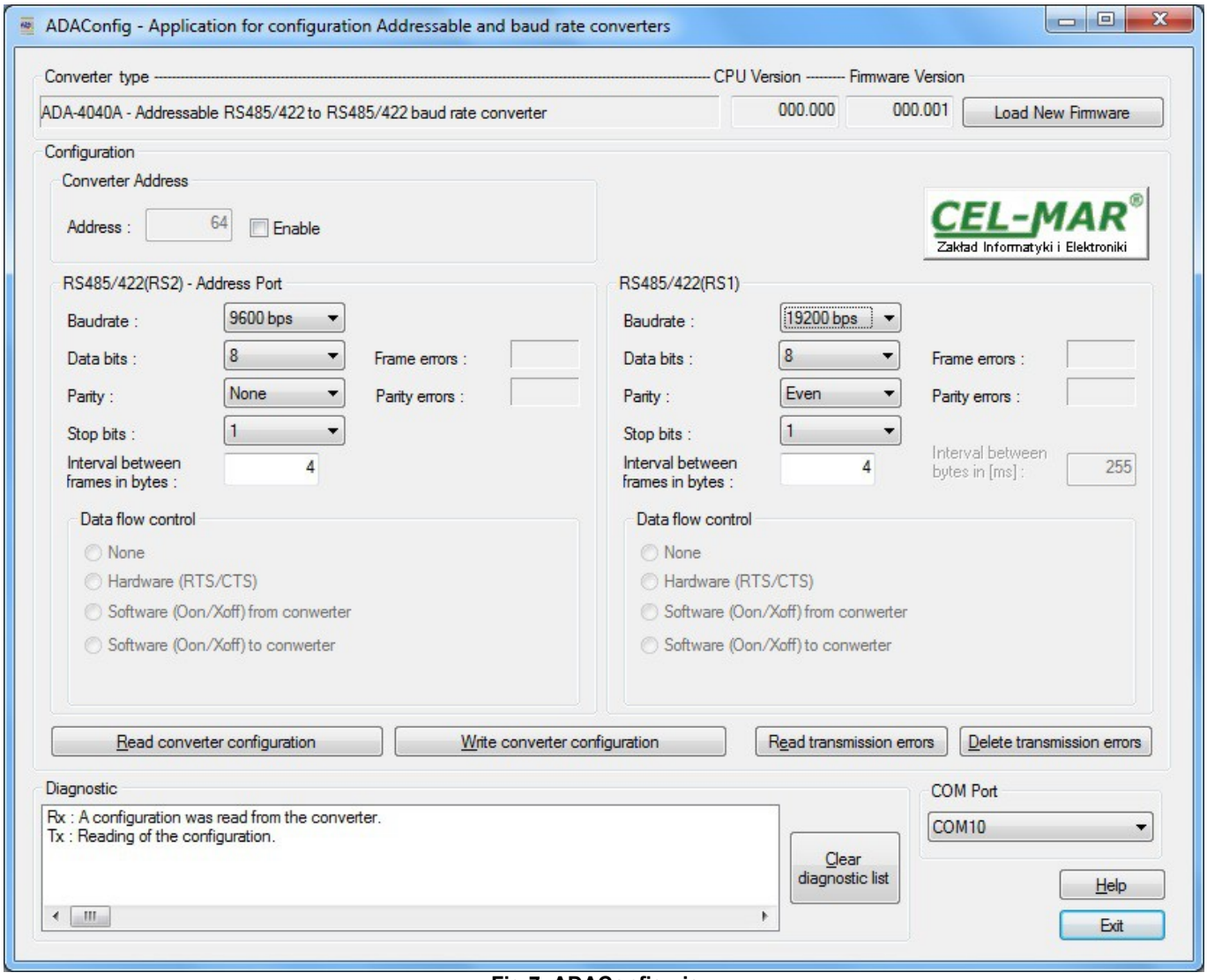

Fig 7. ADAConfig view

5.3. FIRMWARE UPDATE

Set SW1 micro switch to configuration mode as in table below

SW1-1	SW1-2
ON	OFF

Yellow LED will blink with frequency 1Hz in the configuration mode. Press a button ***[Load New Firmware]*** to change the software delivered by manufacturer. The Select File window will open (Fig.8) and select the *.bin file then click ***[Open]*** - software will be load to *ADAConfig* buffer storage and will be checked. If the *ADAConfig* not detect errors in loaded file you can change converter software. Process of updating is visualized by *ADAConfig* in use Progress Window and after proper changing confirmed by correct message.

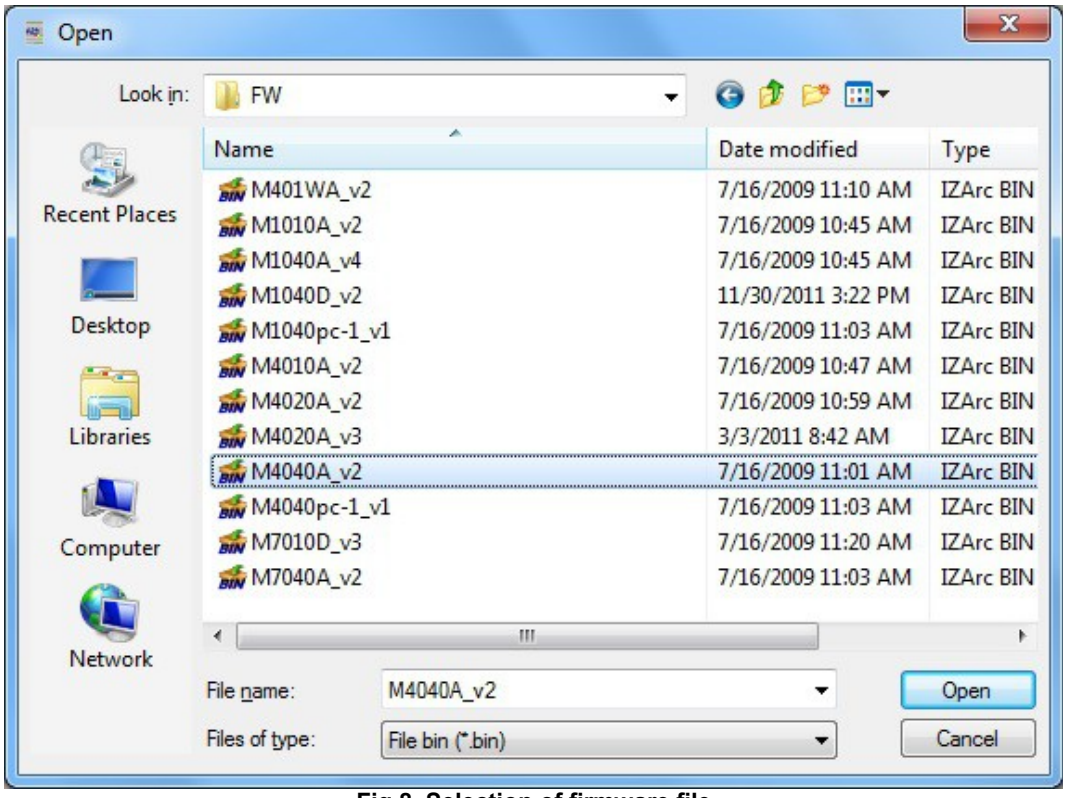

Fig 8. Selection of firmware file

During loading software the yellow LED located beside SW1 micro-switch will blinks, showing data flow to ADA-4040A. If the software loaded correctly yellow LED will be blink with frequency 1 Hz.
After that set micro switch SW1 to run mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

Yellow LED will be OFF

5.4. EMERGENCY FIRMWARE UPDATE

In case of the unsuccessful update of the converter software, try again according to description in point 5.2. If the update is still incorrect use emergency firmware update. You have to set SW1 microswitch mode as in the table below.

SW1-1	SW1-2
ON	ON

After micro-switch setting restart the ADA-4040A by turning OFF and then ON the power supply. The yellow LED will light and the converter will be in Emergency Firmware Update mode. Now follow the description in point 5.2.

ATTENTION!
AFTER SUCCESSFUL UPDATING SET SW1MICRO-SWITCH AS IN TABLE BELOW

SW1-1	SW1-2
OFF	OFF

5.5. FACTORY DEFAULT

In case of faulty functioning ADA-4040A:
- no communication in the configuration mode,
- transmission errors on RS485/422 bus,

can be restored the factory default setting of the converter internal registers.
Set SW1 microswitch mode as in the table below.

SW1-1	SW1-2
ON	OFF

Disconnect the power and after while connect again the power. After that, will be loaded the factory default setting to the converter internal registers.
After this operation, the converter parameters should be set again for operating in the application.
Set micro switch SW1 to run mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

6. BAUD RATE DIAGNOSTICS

To readout diagnostics you should set SW1 to configuration mode (see paragraph 5.1).
Correctness of transmission proceed on RS1 and RS2 you can check by readout the errors list by *ADAConfig* Software form the converter memory. Frames error counter will be increased, in case of: improper speed set compared to real speed of data transmission. Parity error counter will be count the errors which can arise in case of misrepresent bytes in transmitted sign. This counter will not work in case of disable control parity. If you want to check this counters press the button ***[Read transmission errors],*** and to delete (zeroing of counters in the memory of the converter) press ***[Delete transmission errors].***
In case of parity errors or frame errors you have to check ADA-4040A converter's configuration and correctness connection of RS485 network to RS1 port and addressable device to converter's RS2 port.
When you will finish diagnostic you have to set SW1 micro-switch to run mode (see paragraph 5.1).

7. OPERATION

The ADA-4040A converter can operate in to two modes: not addressable and addressable.

7.1. OPERATION IN NON ADDRESSABLE MODE

In this mode ADA-4040A operates as baud rate converter and data format converter and lets to set different baud rates and data format on RS1 & RS2 interfaces. It lets connect to RS485 network old devices operate with non-configure baud rate and data format, on which operate devices with different baud rate or data format.

7.2. OPERATION IN ADDRESSABLE MODE

In this mode ADA-4040A operate as baud rate converter and data format converter and lets to connect no addressable devices with RSRS485/422 interface, transmitting data at different rates and formats of data frame to the RS485 bus, in the process of enabling the cooperation with addressable devices.
Example connection of ADA-4040A is shown on fig. 9 and fig.10.
Frame of protocol for no addressable RS485/422 devices connected to RS2 of ADA-4040A should be created in the following way:

ADDRESS ADA-4040A	***FRAME OF NO ADDRESSABLE DEVICES***

Where::

ADA-4040A ADDRESS - one byte of address from 1-255 scope, - set in the memory of ADA-4040A during configuration in use of *ADAConfig,*

FRAME OF NO ADDRESSABLE DEVICES - free sequence of bytes containing the appropriate frame of device, connected to RS2 port. Not longer than 950 bytes.

ADA-4040A converter with set up addressing is listening constantly to frame on RS485 bus via RS1 port. If received frame contains byte of address equal to address of converter, then another bytes of frame are received, right up to silence on RS-485 bus equal to 'space between frames in signs'. If the frame is received correctly, the address byte is deleted and transmitted over as typical to the RS2 port. In case of errors in received frame, it isn't transmitted to RS2. In this case should be send the previous frame one more.
The frame received from device connected to RS2 port is being tested of transmission errors and in case of their missing converter adds address to beginning of frame and send it to RS-485 bus through RS1. Frame containing errors isn't being transmitted to RS1 port. In case of transmitting of frames containing more than 950 bytes converter receive only 950 bytes and next are ignored. ADA-4040A has equipped with separate buffers for RS1 and RS2, therefore converter can operate in full duplex mode on RS-422 and RS-485 4-wire bus.
Figure 9 and 10 present possibility of using the addressable ADA-4040A baud rate converter.

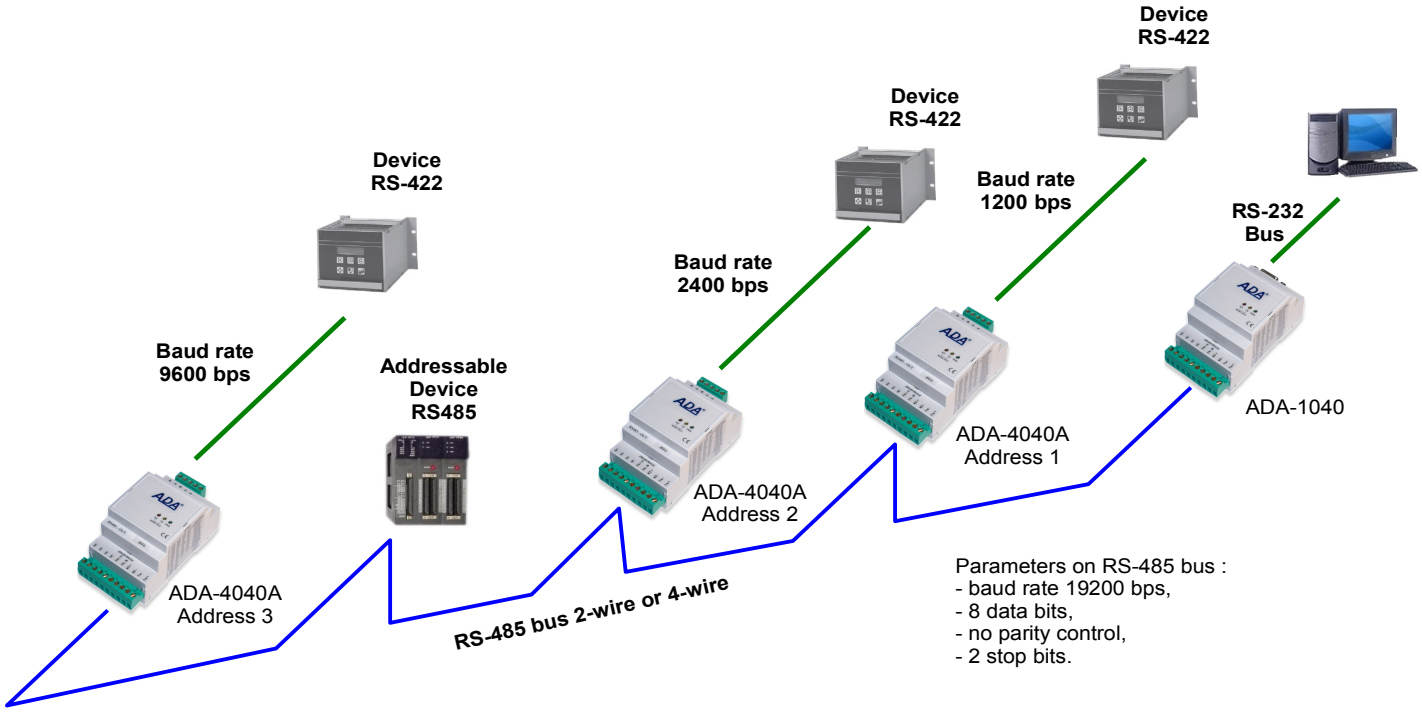

Fig 9. Connection of no addressable RS422 devices to RS485 bus

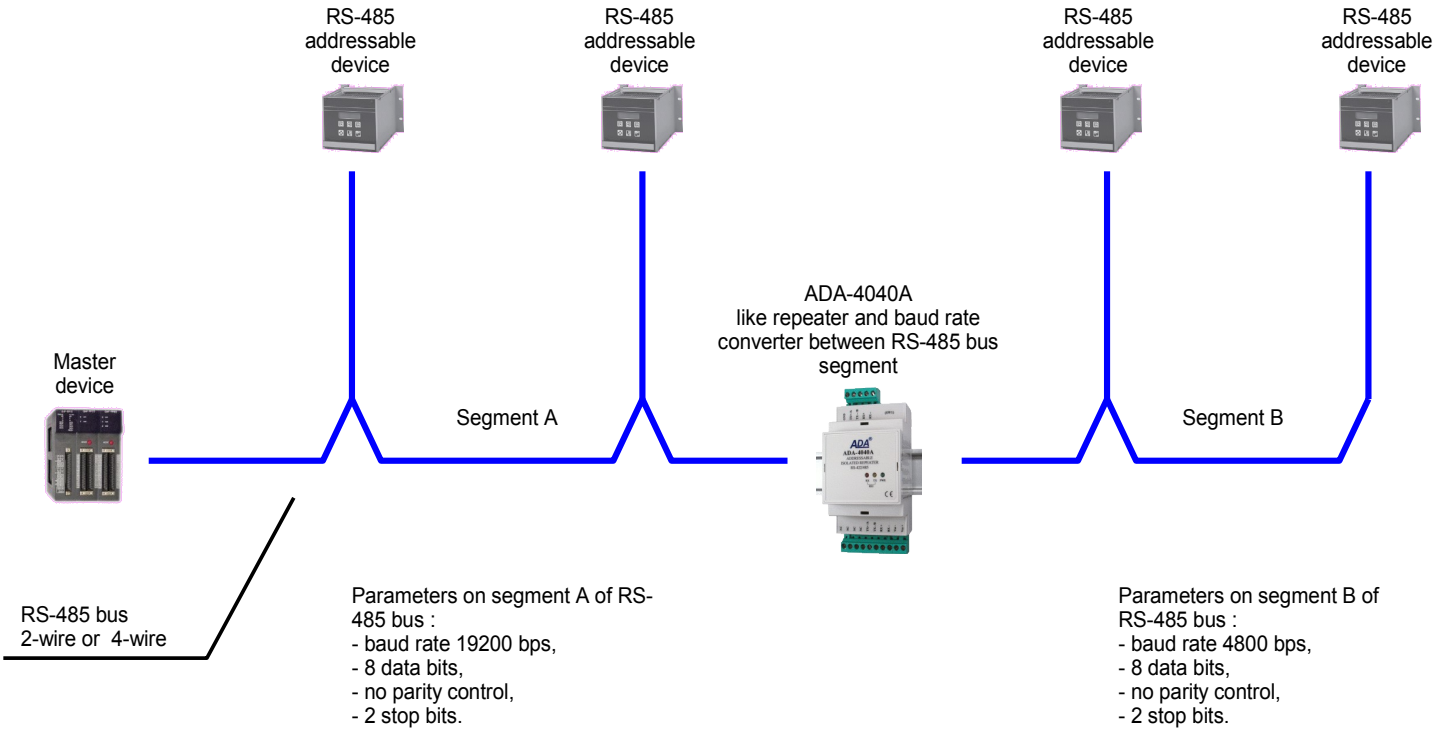
RS-485 addressable device
RS-485 addressable device
RS-485 addressable device
RS-485 addressable device
Master device
Segment A
ADA-4040A like repeater and baud rate converter between RS-485 bus segment
Segment B
RS-485 bus 2-wire or 4-wire
Parameters on segment A of RS-485 bus :
- baud rate 19200 bps,
- 8 data bits,
- no parity control,
- 2 stop bits.
Parameters on segment B of RS-485 bus :
- baud rate 4800 bps,
- 8 data bits,
- no parity control,
- 2 stop bits.

Fig 10. Connection of RS485 bus segments with different baud rate and format data frame devices, additionally galvanic separation of bus segments

8. VERSIONS

ADA-4040A - [ ] - [ ]

Galvanic isolation:	
1kV=, 2-way	**2**
1kV=, 3-way	**23**
3kV=, 2-way	**3**
3kV=, 3-way	**33**

Terminal & Terminal Cover:	
Cover without inlets, screw terminal block	**1**
Cover without inlets, screw terminal block	**2**
Cover without inlets, plug-in screw terminal block	**3**

Order example:
Product Symbol: **ADA-4040A-23-3**
23 – 3-way galvanic isolation on the level 1kV=,
3 - cover without inlets, plug-in screw terminal block,

9. SPECIFICATION

Transition Parameters		
	RS-485/RS-422 (RS1)	**RS-485/RS-422 (RS2)**
Connector	Screw terminal block - max. Ø 2,5mm^2	Screw terminal block - max. Ø 2,5mm^2
Line length	1200 m (depend on baud rate)	1200 m (depend on baud rate)
Max. number of connected device	32	
Baud rates	300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,	
Data format	• Data bit: 5, 6, 7, 8, • Parity: None, Odd, Even, • Number of stop bits: 1, 2,	
Transmission line	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5 (24AWG)	
Transmission type	Asynchronous full duplex, half duplex.	
Standards	EIA-485, CCITT V.11	
Optical Signalization	• PWD – green LED power supply, • RX - red LED data receiving on RS1 – RS485/RS422 side,	

	• TX - yellow LED data transmission via RS1 – RS485/RS422 Bus.
Nominal Operating Conditions	
Power requirements	10 – 30 V DC
Power Cable	Recommended length of power cable – do 3m.
Power	<2W
Protection from reverse power polarization	YES
Galvanic Isolation	1kVDC or 3kVDC - between power circuit and RS-485/RS-422 (RS2) signal line
Optoisolation	~3kV - between signal lines RS-485/RS-422 (RS1) and RS-485/RS-422 (RS2)
Operating temperature	0 ÷ +23 ÷ +50°C
Humidity	5 ÷ 95% - non-condensing
Location during work	Free
Mounting	Rail mounting according to DIN35 standard / TS35.
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.
Safety requiring	According to the PN-EN60950 norm.
Environment	Commercial and light industrial.
Cover	
Dimensions	53 x 90 x 58mm,
Material	Noryl UL. 94 V-O
Degree of casing protection	IP40
Degree of terminal protection	IP20
Weight	0,10 kg
According to standards	DIN EN50022, DIN EN43880
Storing and Transportation	
Storage temperature	-40 ÷ +70°C
Humidity	5 ÷ 95% - non-condensing

Dear Customer,

Thank you for purchasing **CEL-MAR Company** product.

We hope that this user manual helped connect and start up the **ADA-4040A converter.** We also wish to inform you that we are a manufacturer of the widest selections of data communications products in the world such as: data transmission converters with interface RS232, RS485, RS422, USB, Ethernet, Wi-Fi, Current Loop, Fibre-Optic Converters and other.

Please contact us to tell how you like our products and how we can satisfy you present and future expectation.

CEL-MAR sp.j.
Computers Science and Electronic Factory
str Sciegiennego 219C
25-116 Kielce, POLAND

Tel.....: +48 41 362-12-46
Tel/fax.....: +48 41 361-07-70
Web..... : http://www.cel-mar.pl
Office.....: offi@cel-mar.pl
Sales department..... : sales@cel-mar.pl
Technical information ..... : support@cel-mar.pl